

From the house of Amar Chitra Katha and Tinkle

BRAINWAVE™


SCIENCE IS JUST A GAME

Vol. 02 Issue 08
August 2013
48 pages
8-15 years
₹60

All About Physics
Stories, comics & more

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Goodies*

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LEAD>START
Publishing

At the outset, I liked the last issue, especially its appearance. The content is also very rich. I do appreciate the entire team's effort to present something that is reader-friendly and educative. In short, it's edutaining -
AS Manekar, Dy. Director General, National Council of Science Museums



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The World of Physics

Dear young readers,

Physics is hard to appreciate, but wonderful when you do. Physics is about everything - the physical universe around us. Knowing a little more about it makes you see things in a new way.

Physics is difficult. But, it is incredibly satisfying when you put in the effort and understand it. I had a lot of trouble with physics in college. After months of struggle, I realised that it was because I never bothered to understand why I should study physics and how I would be applying the problem-solving skills in real life. Once I put in effort to understand that, I  got attracted to it!

And you know what? Understanding and being good at physics makes maths easy too!

SK, sasikanth.c@ack-media.com

BRAINWAVE™

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■+ PHYSICS AND THE UNIVERSE



FUN-DO AND LEARN

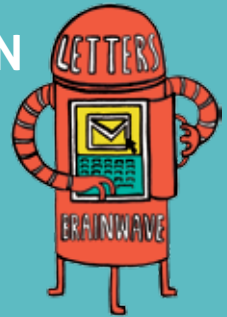
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MEET THE SMARTIES



Dr. Dodo: Dr. Dodo is the co-founder of BW Labs and is the last living dodo. He holds a PhD in anachronomaly and parallel universes from the University of Clockwindistan. He invented the Galileo series of time machines.



Skree!: Skree! is the other founder of BW Labs. She loves dangerous experiments. She makes mini black holes before breakfast and has dark matter for lunch.



Arby: Arby is a genius who will grow up to be Aryabhata. He came to the future, thanks to Dr. Dodo's time machine. He is a fan of numbers, banana fritters and robot wars.



Mr X: Mr. X, short for Xavier, was once Dr. Dodo's student. X is as brilliant as Alby and Arby, and by virtue of his knowledge of science, as powerful as Bhoo when the situation demands.



Bhoomi: Bhoomi, a.k.a. Bhoo, is an enigma. No one knows where she is from and how she came into being. She is made up of earth, wind, fire, and water in equal parts. Her alter-ego is Gaia Goel, a world famous science sleuth.

Alby: Alby will grow up to be Albert Einstein. However, now, like Arby, he too has been sucked into the future. When he is not researching, he plays the violin.





HOW DO PLANES LIKE THE BOEING 747 FLY IN AIR EVEN WHEN THEY ARE SO HEAVY?

- Prathul Venkatesh



Artwork: Saudamini Tamboay

If something is heavier than air, its weight makes it fall to the ground. Planes are held up by a force called **lift**^G, generated by the plane's wings. When airplane wings move through the air at an angle, they push air downwards, like the blades of ceiling fans do. The wings are lifted up by this.

The wings of planes are not flat, but have a curved upper surface. This helps push the air that is above the wing down and add to the lift. Since the lift comes from the plane's movement against the air, the plane has to move above a certain speed in order to keep flying. ■

PLANTS HAVE NO HEART. HOW DO THEY LIVE? - Pratik Harihar

Plants may not have hearts, but they have mechanisms that transport food, water and nutrients to every part of even the largest tree. Hence, they don't need hearts.

Most plants are made up of transport tissue called xylem. Xylem has bundles of narrow tubes that behave like drinking straws. These tubes suck water and nutrients from the roots and transport them to various parts of plants.

Plants utilize the water, nutrients and sunlight to manufacture food that is in the form of sap – sugars and other nutrients in

water. This food is sent from leaves, where it is made, to branches, roots and stems, where it is stored as fruits or vegetables.

This transportation of food happens through tissue called phloem, from areas of higher concentration to areas of lower concentration - generally in the downward direction.

While plants utilize no energy to transport water and nutrients through xylem, they burn energy to transport food through phloem. ■

Have a burning question? Email us at brainwave@ack-media.com with 'Ask Us Why' as the subject. The best question gets published and wins two cool Amar Chitra Katha comics!

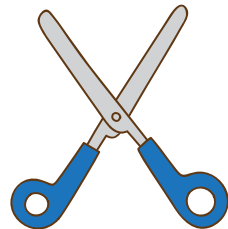
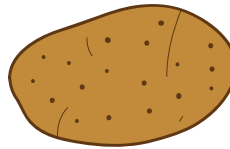
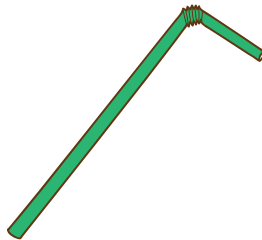


Air Knife!

by Arvind Gupta & Kayomarz Bacha

You will need:

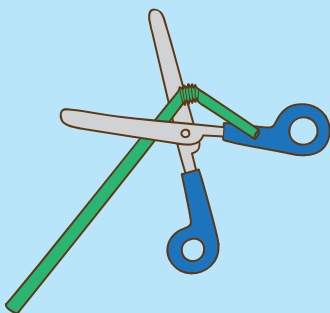
- A straw
- A potato
- A pair of scissors



Method:

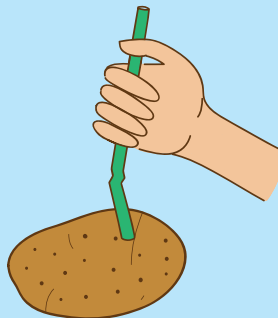
Step 1

Cut off the bent neck of the straw.



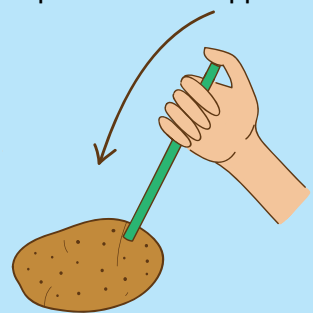
Step 2

Hold the straw normally and stab the potato. What happens?



Step 3

Cover the tip of the straw with your thumb and stab the potato. What happens?



Artwork: Kashmira Sarode

Why does this happen?

By covering the tip of the straw with your thumb, you are trapping the air in the straw. As we know, air exerts pressure. This pressure helps the straw pierce deep into the potato.

This phenomenon can also be related to Newton's law of inertia which states that 'an object at rest tends to remain at rest, and an object in motion tends to remain in motion'. ■

SCIENCE FACT

While pushing a bike or car, you notice that it is difficult to get it moving. But, it moves smoothly once it gains momentum. That bike or car will stop only once external force is applied in the form of friction or brake.

What is inertia? How is it useful and what are its applications in day-to-day life? Research and email your answers to brainwave@ack-media.com. The best answer wins two cool comic books!



Flying without a pilot

The U.S. Navy has now launched an unmanned, autonomous aircraft the size of a fighter jet! This drone can take off and land from any carrier, preventing the need of taking permission to use airfields in

other countries.

The drone, X-47B, is even more special because it does not need to be piloted or remote controlled. Instead, this aircraft is controlled by sending orders to an on-board computer which uses artificial intelligence to think for itself, plotting course corrections and charting directions.

While critics warn that the introduction of such AI into military weapons systems is a step towards the development of autonomous 'killer robots', navy officials say the drone will give them around-the-clock intelligence, surveillance and targeting capabilities. ■

Source: Daily Mail



110 years of glow

Some mysteries keep puzzling mankind forever. Doing just that is a humble light bulb in California. Situated in Livermore's Fire Station No. 6, this light bulb has been working for the last 112

years! Even with today's advanced technology and techniques, no one can figure out how.

This mystery bulb was first installed in 1901, replacing the kerosene lanterns that then illuminated the fire station. The never-ending glow of this bulb was not noticed by anyone for the first 71 years. Things changed in 1972 when an intrepid cub reporter named Mike Dunstan at the Livermore Herald News cracked the story of 'the bulb that never went off'.

This light bulb is about 3 inches long and slightly rounder than a modern light bulb. Inside the glass is a jumble of carbon filament that radiates about 4 watts of soft orange light - about the strength of a night-light.

This bulb has now made its place in history by winning the title of 'the oldest known working light bulb' by the Guinness Book of World Records and Ripley's Believe-It-or-Not. ■

Source: Daily Mail

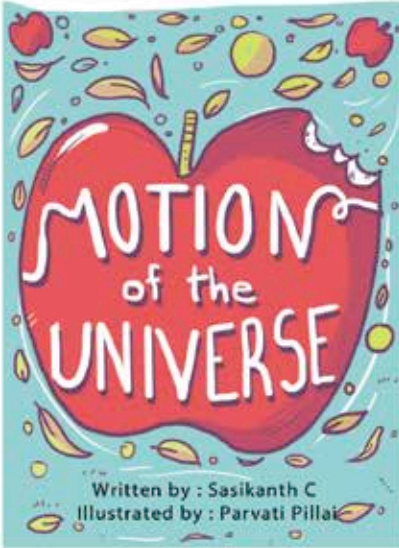
The joy of subtitles

If the hearing impaired take a trip to the movies, it would mean watching moving images without understanding the plot. But now, the theatre experience for them is equally enjoyable, as the Regal

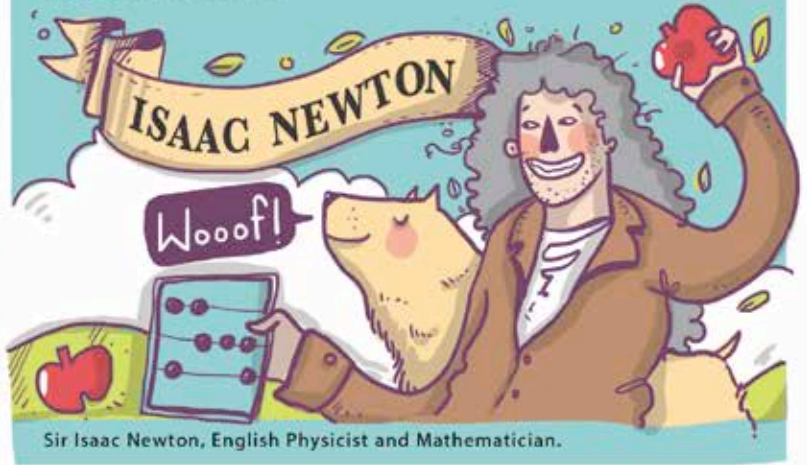
Cinemas has introduced closed-captioning glasses across 6000 screens in the US.

These Sony Entertainment Access Glasses are sort of like 3-D glasses, but for captioning. The captions are projected onto

the glasses and appear to float about 10 feet in front of users. The glasses also come with audio tracks that describe the action on the screen, and boost the audio levels of the movie. Another reason to stay glued to the big screen, right? ■



Every once in a while, someone great comes along to unravel the mysteries of the Universe and show us the path ahead. Sir Isaac Newton was one of the greatest of such men.

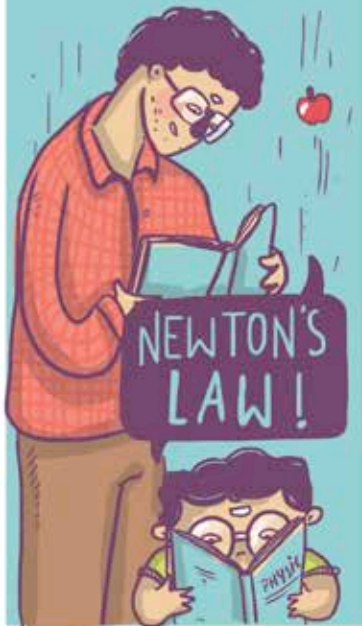


Newton is regarded as one of the most influential scientists of all time and as a key figure in the scientific revolution.



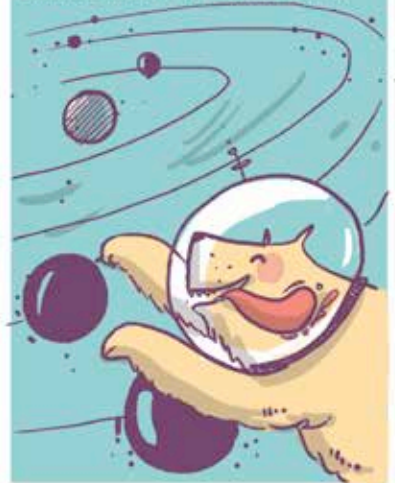
He discovered the significance of the force of gravity, and formulated the laws of motion that describe the relationship between a body, the forces acting upon it, and its motion.

Even after 300 years, Newton's laws are so significant that we study these right from grade 6 to engineering, and even after that!



Why are these laws so significant? Why should we study them?

The universe is filled with and acts the way it does due to forces – gravitational, electromagnetic and nuclear. Newton's laws of motion, combined with his law of universal gravitation, explain how various physical objects and systems in the universe move due to these forces.



The practical applications of understanding this are many. For example:

- What should be the tension in the rod by which our ceiling fans hang, to not fall off?
- What should be the power of the engine of a bike to carry us even up a slope?
- How can we build pulley, cranes and elevator systems to lift heavy objects?
- What should be the acceleration of a rocket to escape the Earth's gravity?
- How do planets, comets, satellites, stars and galaxies move? Can we study these and understand the universe better?



Anything that moves in the Universe moves according to Newton's laws of motion and gravity - they are so precise! And to think, Newton began this contribution at the age of 23!



Here's an interesting anecdote - it is said that Newton's mother wanted him to be a farmer. In fact, when he was 17, she made him quit school and learn about the farm! Fortunately for us, Newton stayed peevish and did not cooperate until, after 9 months, his uncle Reverend William Ayscough helped Newton get back to school!



Newton contributed to the development of science by not only setting into motion the study of modern physics (and mechanics), but also by contributing immensely to astronomy, mathematics, optics, alchemy and chemistry. He invented the reflecting telescope to study the motion of comets and planets. He investigated the refraction of light, demonstrating that a prism could decompose white light into a spectrum of colours.

He even developed calculus to calculate the motion of these objects. The same formulae apply, even today, to build missile launchers, rockets, space probes, satellites, cars and all other things that move!

In 1705, Newton was knighted by the queen during her royal visit to Trinity College, Cambridge. He was only the second scientist to have been knighted!



Newton's heart was as great as his head. It is said that his pet dog *Diamond* once caused a fire that resulted in 20 years of Newton's work being burnt to ashes. Newton simply stroked the dog's head, looked at it with pity saying, 'Diamond, you know not what you have done' and started writing again!

It is very difficult to forgive a wrong done to us. Imagine the amount of will and compassion Newton had!



Moved by Newton's accomplishments, the English poet Alexander Pope wrote the famous epitaph:

NATURE AND
NATURE'S LAWS
LAY HID IN NIGHT;
GOD SAID
"LET NEWTON BE"
AND ALL WAS LIGHT.

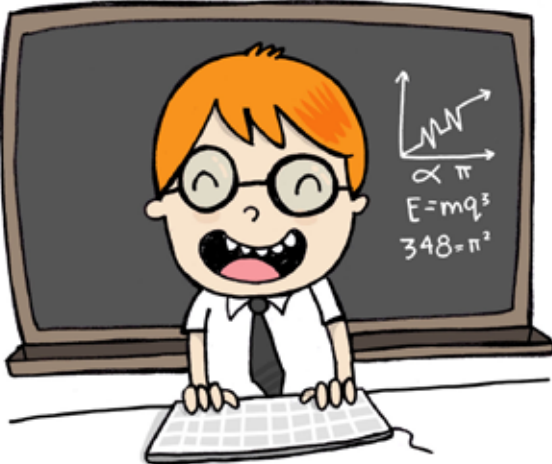




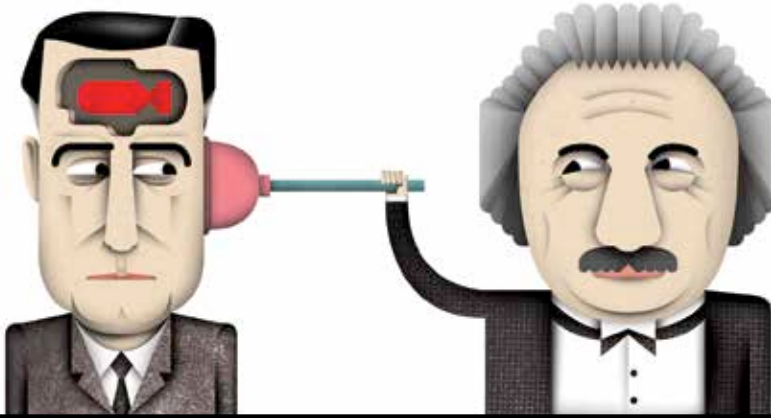
In May 2010, the space shuttle Atlantis took off from the Kennedy Space Centre with an interesting piece of cargo on board - a 4-inch piece of wood from Newton's famous apple tree!



To put an end to our traffic woes, NASA is said to be working on a personal flight vehicle called the Puffin. It stands on its tail when parked on the ground and can fly at 140 miles per hour!



In 1996, American physicist Alan Sokal submitted a paper to a very respectable science journal called Social Text. He waited till it was published and then cracked up and confessed that the paper was loaded with senseless jargon and made-up theories on quantum gravity. What 'nonscience'!



Artwork: Somesh Kumar



by Priyanka Talreja

Let's take a look at why Albert Einstein said he wanted to be a plumber!

"If I would be a young man again and had to decide how to make my living, I would not try to become a scientist or scholar or teacher. I would rather choose to be a plumber in the hope to find that modest degree of independence still available under present circumstances."

– Albert Einstein told *The Reporter* on 18 November 1954.

Why did the greatest physicist ever want to be a plumber? Theories are many, but here is the most popular one -

It was in 1939, just a few months before the beginning of World War II in Europe, that Einstein wrote a letter to the US President Franklin D. Roosevelt and alerted him of the possibility of German scientists developing nuclear weapons for Adolf Hitler.

In the letter, Einstein expressed his fears by stating that through recent studies in nuclear physics, it would be possible to set up a nuclear chain reaction in a large mass of uranium, and that the same phenomenon may also lead to the construction of extremely powerful bombs.

Before Einstein knew it, this

letter became the key reason for the US to launch serious investigations into nuclear weapons. It is said that President Roosevelt could not take the risk of allowing Hitler to possess atomic bombs first. This resulted in America successfully developing the first atomic bomb during World War II and bombing Hiroshima and Nagasaki!

This evil use of atomic energy left Einstein shaken. In 1954, just one year before Einstein met his end, he said to his old friend, Linus Pauling, "I made one great mistake in my life — signing the letter to President Roosevelt recommending that atom bombs be made." ■

Sad, but true:

Atomic bomb blasts sometimes may not kill people, but will leave them in a far worse condition. This happened in Hiroshima and Nagasaki. Many survivors suffered from cancer, tumor and cysts. Radiation effects are still being observed in the survivors and new

generations, even after 60 years! Most of the younger generation of Hiroshima and Nagasaki were born with abnormalities such as prenatal blindness or deafness, stunted brain growth, deformed bone structure, and heart and lung problems.

Even small scale use of atomic weapons could devastate the world's eco systems. These damages are likely to continue for decades. Radiation can float in the upper reaches of the atmosphere and spread to the other parts of the world or destroy the ozone layer. ■



*Draco and Snowy
come face to face
with the mysterious
universe, again.*

PHYSICS AND THE UNIVERSE

by Priyanka Talreja
and Sasikanth C

Artwork: Saudamini Tamboy



Trillian was sitting at her supercomputer going tick-tock-tick-tick at her keyboard. It was a very busy day. Working with the Supreme Peacekeeping Force of the universe was not easy. She had to file regular reports on the recent happenings, and her observations.

This time, there was a lot Trillian had to report about. Two black holes had merged to become one huge, mean, black hole. She had also noticed the birth of five new stars. Life all around was peaceful - there were no star wars and humans hadn't yet discovered any alien life forms.

Suddenly, almost startled, she looked up at the calendar. She had remembered something, - the date! It was the 20th of August on the Earth! This was the day she had met Draco and Snowy 10 Earth years ago. And this was the day she had promised to meet them again and show them more of the universe!

She quickly finished her work and zoomed off towards the Earth. She first travelled to the Himalayas to get Snowy - the abominable snowman. She spotted him in an instant. He was carrying his latest ice sculpture into his snow laden abode. "Need some help?" asked Trillian, from the spaceship's speaker.

"Oh! Hi Trillian, I was just preparing to leave with you. I'm all set to go!" he exclaimed.

"Ok then, let's go," Trillian said and pulled him into the ship with the anti-gravity laser.

"Thanks Trillian. Let's now pick up the big fellow," Snowy chuckled. "He now lives in K2, the second highest peak in the world."

"Really? He went to K2! China, here we come."

In a jiffy, the spaceship was over K2. Draco, the dragon was just getting out for some fresh air. Before he knew it, Trillian pulled him into the spaceship.

"Heyyy! Stop doing that. I would have had a heart attack right now!" exclaimed Draco, while he sighed and exhaled some fire.

"Okay, now that all of us are together, let's head right into space. As always, I am short on time," said Trillian as the spaceship shot up towards the sky.

"Trillian, I have a major question for you - knowing about the Universe is very fascinating. But, how does it help? Why do we need to even bother?" queried Draco.

"That's actually a very good question," said Trillian encouragingly. "Had I not read about and understood the Universe, we would not be having this conversation right now."

"Huh? What do you mean by that?" asked a confused Draco.

"Well, there is science behind everything in the Universe, it could be biology, physics or chemistry. Understanding the Universe better is the key to every modern technology we have ever developed - this super-spaceship, for instance."

"Wow! Please continue. Explain in greater detail," Snowy and Draco chorused.

"Ok. But I am short of time. So, we will discuss only physics this time," agreed Trillian. "Physics is the fundamental science. It explains how the Universe behaves - from the subatomic level to the extragalactic level."

"It describes the most basic objects, the forces between them, and how they



“What? No Draco! It is not all light and bright. Our universe is completely dark. Most of it is,” interrupted Trillian.

“But, there are probably more than 100 billion galaxies in the cosmos. Each of those has between 10 million and a trillion stars!” commented Draco.

“Yes, but the fact is that most of the universe is made up of dark matter and dark energy. The rest - everything on the Earth, everything ever observed, and all normal matter - adds up to less than 5%!”

“Unbelievable! But, what are dark matter and dark energy?” asked Snowy and Draco.

interact,” explained Trillian.

“Hmm ... can you give us some examples so that we can understand better?” asked Draco.

“Yes, physics tells us how heavenly bodies behave, where light comes from, how birds fly, and almost everything else. Understanding these things, and hence understanding physics gives us extraordinary power over the world, right from building computers to spaceships, and driving cars to travelling in time.”

“It would not be wrong to say that every invention ever conceived makes use of the principles of physics,” concluded Trillian.

“Wow! I love the Universe even more now. It is so exciting! Bright and full of light,” said Draco.

“That's a little complicated. But I will attempt explaining it in the language of the Earthlings. Albert Einstein was the first human to realise that empty space is not nothing. Space has amazing properties, many of which are just beginning to be understood on the Earth,” said Trillian as the spaceship came to a halt, floating in the middle of nowhere.

“The visible universe - including the Earth, the Sun, other stars, and galaxies - is made of protons, neutrons, and electrons bundled together into atoms.”

“The rest of the universe appears to be made of a mysterious, invisible substance called dark matter, and a force that repels gravity known as dark energy.”

“Fascinating! Please go on,” requested Snowy and Draco, stunned.

“Scientists on the Earth have not yet observed dark matter directly. But they have a few ideas for what dark matter might be. It is hypothesised to account for a large part of the total mass in the Universe. It cannot be seen directly with telescopes; evidently it neither emits nor absorbs light or any other electromagnetic radiation at any significant level. But, its existence and properties are evident from its gravitational effects on visible matter, radiation, and the large-scale structure of the Universe. The Universe contains about 27% dark matter.”

• “If normal matter is just 5% and dark matter is 27%, the remaining 68% of our universe is dark energy?” questioned Snowy.

“Yes. As we know, the universe is expanding and growing apart. Previously, physicists had assumed that the attractive force of gravity would slow down the expansion of the universe over time. But when scientists tried to measure the rate of deceleration, they found that the expansion was actually speeding up!”

“Our universe is dark and empty ...” said Draco, stunned.

“... and it is growing apart, thanks to a mysterious dark energy!” asserted Snowy.

“But you would know much more about these things than us Earthlings, right Trillian? Why don't you share that knowledge with us?” questioned Draco.

“Yes, I know more than the Earthling do. But, I too do not understand everything, friends. And I am sorry, I cannot reveal more. I cannot fiddle with nature and try to alter its course! I hope you guys understand,” said Trillian.

“We do,” said Draco and Snowy together. Suddenly, there was a loud, shrill alarm.

“What’s that?” asked a startled Draco. “Oh, oh! That’s my boss calling for me. Something urgent must have come up. I am sorry guys, we have to rush back now.”

“Oh no!” said Snowy.

“When do we meet again?” asked Draco.

“On the 20th of August next year, my time. I shall surprise you guys again,” promised Trillian.

“That's 10 Earth years! Till then, at least guide us on how we can research and understand more about physics and the Universe. You know that we cannot bear the suspense for that long, right?” stressed Draco.

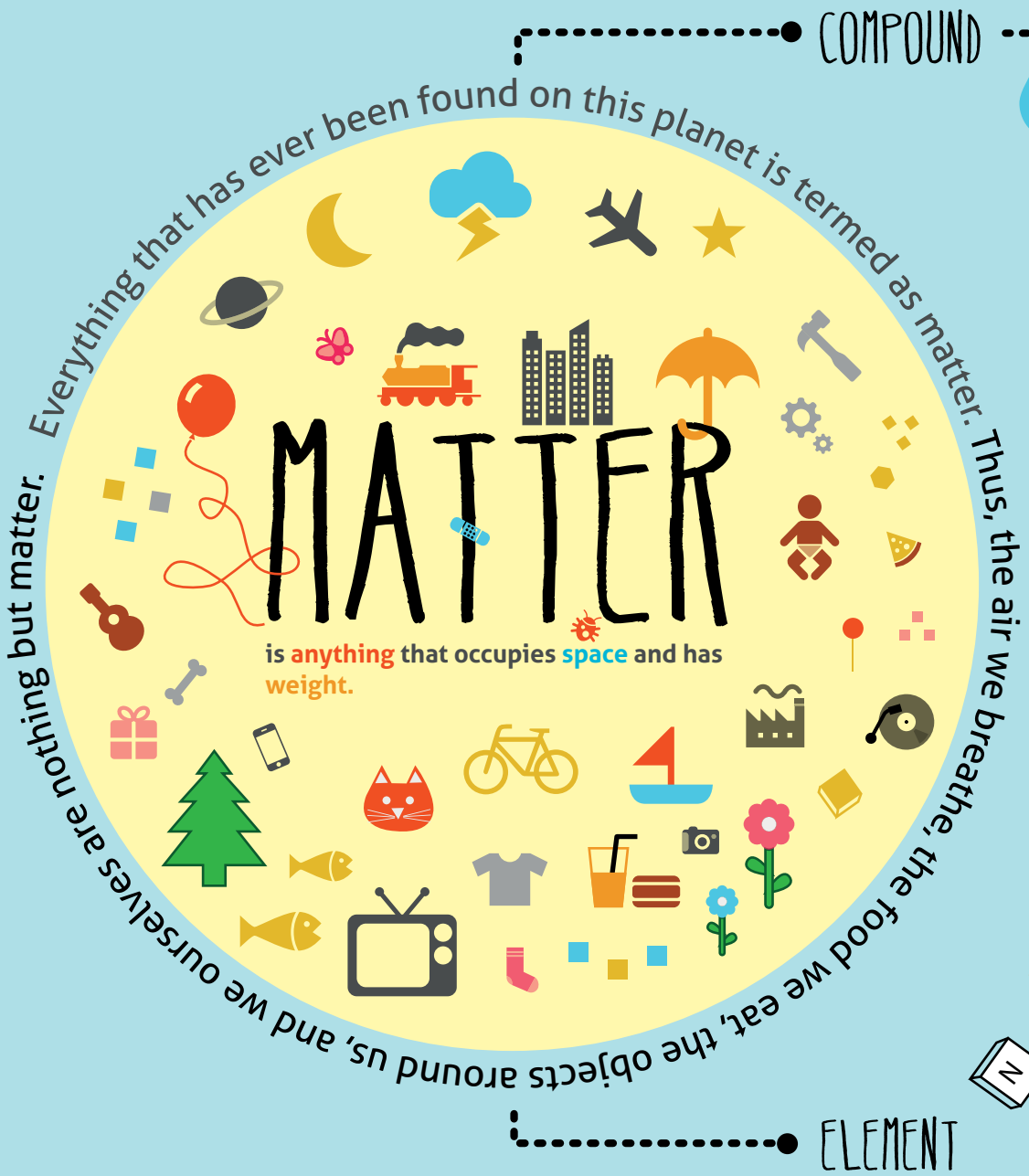
• “Well, ok. Start with reading about the various laws of physics - laws of motion, law of conservation of energy, law of conservation of matter, laws of thermodynamics^G, conservation of electric charge, theory of relativity, Maxwell's equations, etc. You can use Google. Physics sounds like the most complicated subject there is. But it isn't. The beauty of physics is that it is simple, so simple that anyone can learn it,” encouraged Trillian.

“Just remember one thing - as vast as its scope is, you will not be overwhelmed, because one set of ideas in physics builds on those that precede it. And if you are good at physics - you can crack maths too!” she concluded.

And before they knew it, Draco and Snowy were bidding goodbye to the invisible spaceship moving away from them in the sky, from their respective homes on the Earth.

In a blink, Trillian was gone. All of them would now eagerly wait for the next 20th of August, Trillian's time. ■

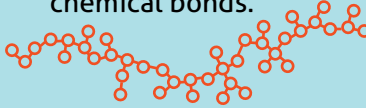
The Basics: Matter Matters





MOLECULES

groups of two or more atoms held together by chemical bonds.

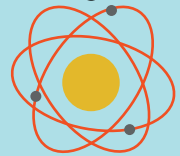


When two or more elements are combined, a compound is formed. A compound is nothing but **two or more types of atoms sharing a part of their structure**. These atoms can be separated by chemical means, but not by any physical means.

Examples : Water (hydrogen + oxygen)
Salt (sodium + chlorine)

HOMOGENEOUS mixtures are substances that combine to form one solution or substance.

Example : Air (oxygen + nitrogen + carbon dioxide and other gases)



ATOM

The **smallest component of elements** that still retain the properties of the element.

MIXTURE

HETEROGENEOUS mixtures are made of different substances that remain physically separate.

This mixture is composed of unrelated or differing parts or elements.

Example : Cereal in milk



The basic, building block of matter. This is the substance that cannot be reduced to a simpler state by chemical means. As of date, there are **116 known elements**. Each element is composed of only one type of atoms.

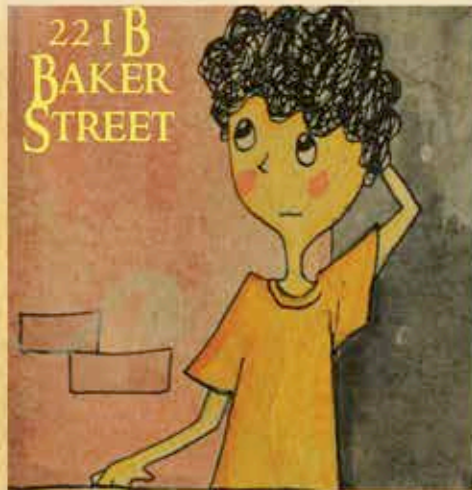


THE TIME TRAVELLING KUMARS - 9

Sherlock
Diaries - 3

Story by:
Sasikanth.C
Artwork by:
Sarthak Sinha

Previously on Sherlock Dairies...
During their time travelling adventures,
Dinesh gets separated from his parents and
lands in early 20th century London,
meeting Sherlock Holmes at 221B Baker
Street. An ardent fan of the world's first and
greatest science detective, Dinesh begins
quizzing him relentlessly.



The conversation is interrupted when
inspector MacDonald rushes in, seeking
Holmes' help on a case - the Merlin diamond
that has been in the mayor's family for
generations is stolen. Before MacDonald
could explain further, Holmes deduces that
the inspector was in charge of security at the
mayor's mansion and had stepped out for a
smoke when the burglary occurred - leaving
the inspector awestruck!

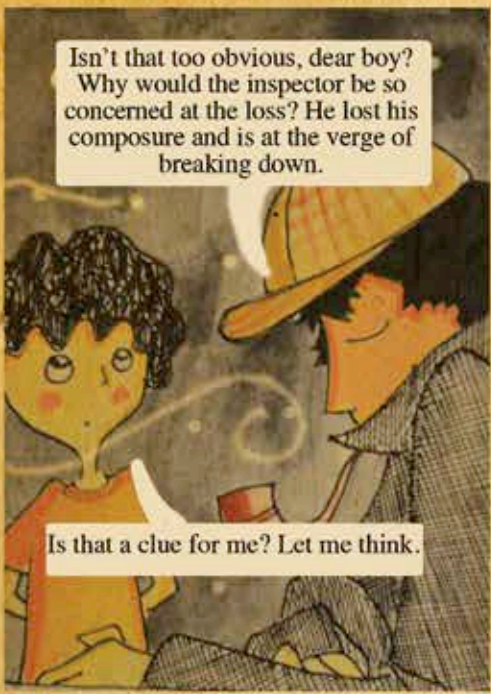
Holmes refuses to budge from his seat saying that 'he is the
highest court of authority and not someone you come to for
petty issues.' However, he gives MacDonald a hint - the
mayor's dogs did not bark on the night of the burglary.



Inspector Macdonald doesn't get the clue and
leaves in a huff. But, Dinesh gets it right - the fact
that dogs did not bark tells that it was the job of
an insider, making it easier to capture the burglar.
But, Dinesh hadn't comprehended everything:

Please tell me - how did you know that the
inspector was on duty when the theft happened
and that he took a break to have a smoke?





Isn't that too obvious, dear boy? Why would the inspector be so concerned at the loss? He lost his composure and is at the verge of breaking down.

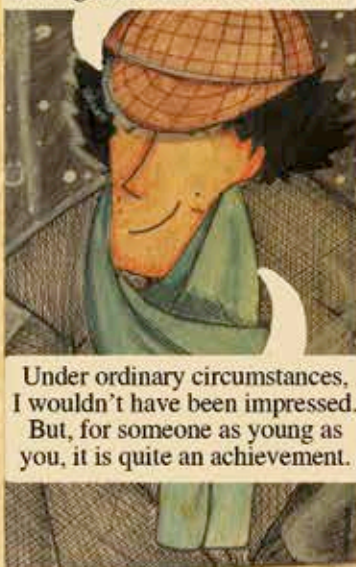
Is that a clue for me? Let me think.



I get it - the inspector is stressed out because he is afraid of something. But, he couldn't have been involved with the crime because if it were so, he wouldn't involve you in the case.



The logical conclusion, hence, can only be that he was in charge of security at the mayor's house when the burglary happened and now, he is afraid that he would be blamed.



Bravo, dear boy! This is what I call abductive reasoning. From a drop of water, a logician can infer the possibility of an Atlantic or a Niagara without having seen or heard of either.

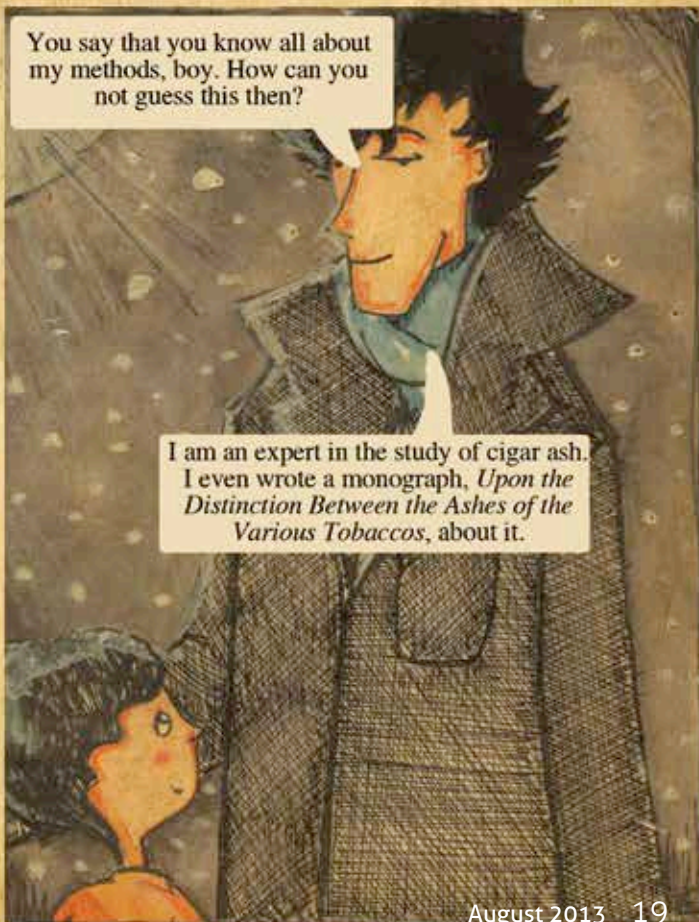
Under ordinary circumstances, I wouldn't have been impressed. But, for someone as young as you, it is quite an achievement.



Thank you, Mr. Holmes! In 2000 A.D, we call this 'Holmesian deduction'. What you say, 'when you eliminate the impossible, whatever remains, however improbable, must be the truth.'



But Mr. Holmes, how did you know that Inspector MacDonald had stepped out for a smoke? He could have just dozed off and not know what happened.



You say that you know all about my methods, boy. How can you not guess this then?

I am an expert in the study of cigar ash. I even wrote a monograph, *Upon the Distinction Between the Ashes of the Various Tobaccos*, about it.

I have devoted some attention to this, and written about the ashes of 140 different varieties of pipe, cigar, and cigarette tobacco in the little monograph.

What inspector MacDonald smoked is an Indian cigar. It gives out a very strong stench. Hence, it is only natural for me to deduce that the inspector must have stepped out for a while to smoke it.

That is great! But, I am still as puzzled as I was before. How do you know what cigar the inspector smoked?

The smell, my boy, the smell. It is only a couple of hours since he smoked it.

Wow! It is exciting to see you in action, Mr. Holmes. I am honoured.

Nothing great, my boy. You hear, see and smell, but you do not observe. I observe and hence, am the best detective around.

Now, do not ask me how I know that the mayor kept dogs. I was just beginning to admire your intelligence. Let us keep it that way.

Please leave me alone for an hour. I need to exercise my brain. There are some important decisions I need to make.

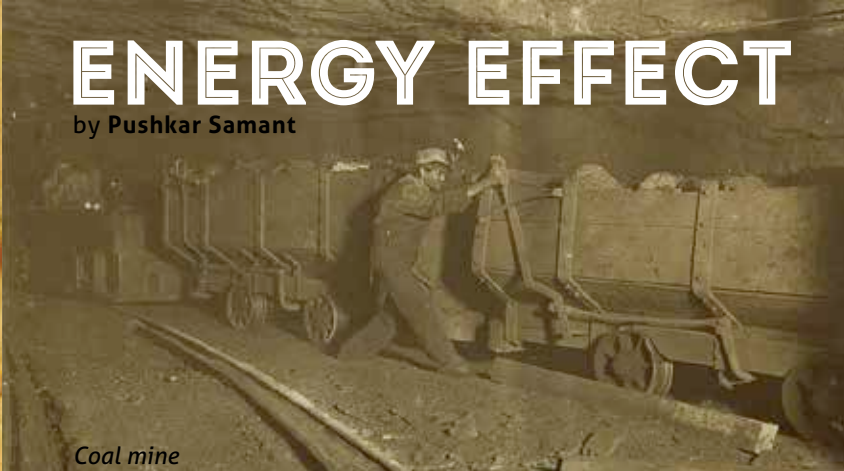
Righto Mr. Holmes. I will go out for a walk. I have always heard that London is beautiful and has an amazing weather during this time of the year.

Hear me out before you leave, dear boy - **SMOKING IS INJURIOUS TO HEALTH. IT KILLS.** Looks stylish and cool, but stinks and spoils your health. I had to research so deeply about it because it is essential for my trade. You see, most criminals smoke.



ENERGY EFFECT

by Pushkar Samant



Coal mine

“What would you like to be when you grow up?” questioned Dr. Dodo in a classroom at the end of his guest lecture.

“I would open a bicycle shop,” said Pooja, the bright one quickly.

“Why so?” asked a bewildered Dr. Dodo

“We’ll be out of fuel in the future, right? And we need it to run vehicles. So, everyone would need bicycles,” replied Pooja firmly.

“Good. But that is not the only reason young ones like you should want to own a bicycle shop,” stated Dr. Dodo with a sigh.

“What else could be the reason?” asked Pooja, curiously.

“The ill-effect of harming nature for our energy needs is also a reason why everyone should

switch to cycles!” answered Dr. Dodo.

“What do energy sources mean?” asked Suraj.

“Petroleum, coal, nuclear, solar, wind, hydroelectric power plants are all sources of energy. We get electrical and mechanical energy, and heat from them,” Dr. Dodo explained.

“But how do these affect the environment?” Suraj enquired.

“In more ways that we can

imagine. Construction and operation of hydropower dams can significantly affect natural river systems and thus the population of fishes. Coal mining can be harmful to air, water and soil quality. And when burnt, petroleum products emit toxins”, said Dr. Dodo.

“I have also heard that nuclear, solar and wind energy are clean energy sources!” Pooja exclaimed.

“Correct, but the ways we generate energy from them are not completely clean,” Dr. Dodo replied with a smile. “Nuclear wastes are hazardous and manufacturing photovoltaic cells in solar panels produces toxic materials.”

“Can we reduce the ill-effects of energy sources?” Pooja asked.

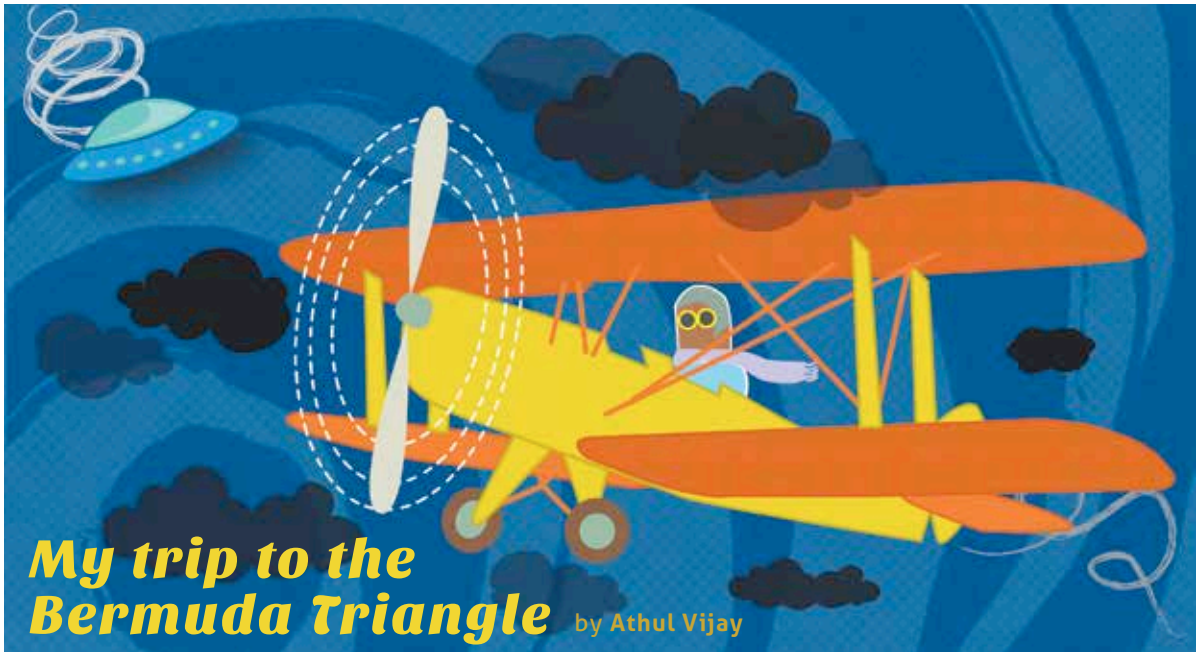
“Yes Pooja, we sure can. But how will we do that? You smart students have to research and email me,” concluded Dr. Dodo. ■



Strip coal mining

Image Source: Wikimedia Commons

Research and email your solutions to Dr. Dodo at brainwave@ack-media.com to get a chance to be nominated for our Student Board as well as win a surprise gift!



Artwork: Ria Rajan

My love for adventure and challenges began when I was a kid, and it has grown with me ever since. I love physics. It helps me create great gadgets to satisfy my deep passion for adventure and challenges.

But my fondness for adventure nearly killed me once. This was when I had set out on a mission to solve the mystery of the Bermuda Triangle or the Devil's Triangle as I would like to call it.

I took my newly made portable Wormhole Creator (I hated the regular time machine as it was an old piece of technology, plus it was broken) and set the right coordinates. Once ready, I pressed the small red button. Within seconds I leaped onto the shores of Miami through a wormhole.

There, I saw my chartered plane, which I had already booked (via the Internet). On it, I set out for my adventure. It all seemed fine till I reached

the Bahamas. There, the plane slowed down, as if some **invisible power was pulling the plane towards itself**. Somehow, I managed and kept flying the plane. Suddenly, due to no apparent reason, it picked up speed - faster than sound!

Soon, the plane was covered in thick black clouds. Through the haze, I saw something flying ahead of me. A saucer-like object; perhaps a UFO?

I had a feeling that it would crash right into me. I closed my eyes in fear. I don't know what happened after that. A couple of days later, I was found lying on the shores Puerto Rico. I was hospitalised for 7 weeks with 2 fractured legs and a broken arm. I also had a severe injury to my head.

I was very disappointed that I could not crack the mystery of the Bermuda Triangle. But, maybe, the mystery is best unsolved. ■

Email your science fiction stories to brainwave@ack-media.com
The most imaginative one gets published here and wins a surprise gift!

Winners of June 2013 issue are:

Toy Box: **Tanmay Gupta**

Ask Us Why: **Ananya Shukla**

Fan Fiction: **Pratul Venkatesh**

Eye See: **Arnav Goel**

Third Law: **No Winner**

Planet Ninjas: **Arthy Shakthibala**

Magic Science: **Tanmay Gupta**

Sci-Q Time: **No winner**

DIY: **Aryan Srivatsava**

Treasure Hunt: **Rahul Nair**

Fun-do Band: **No winner**

Practical Science: **Shobika Murali**

Shobika and **Arthy** get nominated for the BW

Student Board - www.bwmag.in/student-board

The BW Smartenstein title, certificate and mystery gift for March go to **Tanmay Gupta** - www.bwmag.in/category/bw-smartenstein

All Fun-do Band captains - ensure that each of your team members visits and registers individually at www.bwmag.in/fun-do-band Your team membership will be activated only after that. If you face any issues during the process, write to brainwave@ack-media.com

May 2013 winners will be declared in the July 2013 issue.



Letters from Readers

This is my first experience of Brainwave and I found it to be an awesome magazine. I am a regular reader of Tinkle. Till now science was a boring and serious subject for me. I never knew it could be so fun-filled and interesting. The experiments are interesting, "Flash News" is informative and comics are full of fun and knowledge.

Debanjali Mukherjee

Class Vth, Modern Vidya Niketan Aravali Hills Faridabad

Dear Debanjali,

We are glad to receive the email from you. We look forward to your active participation in the contests. That will make the magazine even more interesting. May you win many prizes!
SK, Editor

Today I read about 'Chemical Overload' in the Brainwave magazine. It is a very interesting topic. Today, our mother earth faces so many problems - pollution, deforestation etc. Some of the problems are created due to the vast use of plastics. So, I am very appreciative of the fact that you are including such major topics to increase awareness in all youngsters. Thank you so much, Brainwave.

Aparna P. R., via email

Dear Aparna,

Great to see such level of awareness in you. I look forward to your email with the solutions you propose to solve such issues.
SK, Editor.

I am a great fan of Brainwave. The magazine is amazing. The June 2013 issue: A Chemical Blast is fantastic. After reading it I started enjoying chemistry. Thank you Brainwave team, you made me to love chemistry.

Arthy Shaktibala, via email

Dear Arthy,

Keep up the love for chemistry and write to us whenever you need help. Congratulations on winning the Planet Ninjas contest :)
SK, Editor.



Why did the chicken cross the road?

by Alby

Some men have been very serious and selflessly devoted their lives to physics. But there is no harm in making them a little fun-loving, is there? Let's pose a question to a few of them and see what they say.

Dear Physicists, can you please tell Brainwave, why did the chicken cross the road?





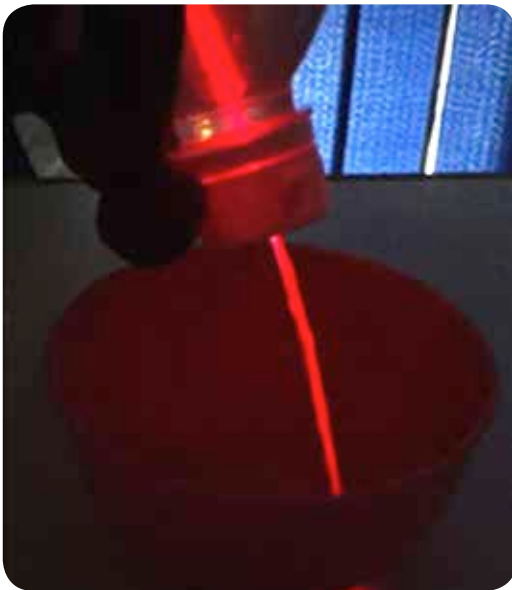
OBSERVE INTERNAL REFLECTION

by Arvind Gupta & Kayomarz Bacha



1 Mix about 10 drops of Dettol in water to make it cloudy.

2 Pass light through the water using a toy laser. You will see the light beam clearly. Pass the light in various angles till you see it reflecting within the medium, as shown here.



3 You can also cut off the top of a bottle and make a funnel. Then, make a hole in the bottle cap to enable a stream of water to pour out of it. While passing water through the funnel, point the laser at the hole in the bottle cap.

.....
This phenomenon is called internal reflection. Research what it is and what its practical applications are. Email your responses to brainwave@ack-media.com and you might win a super comic book pack worth Rs. 500!
.....

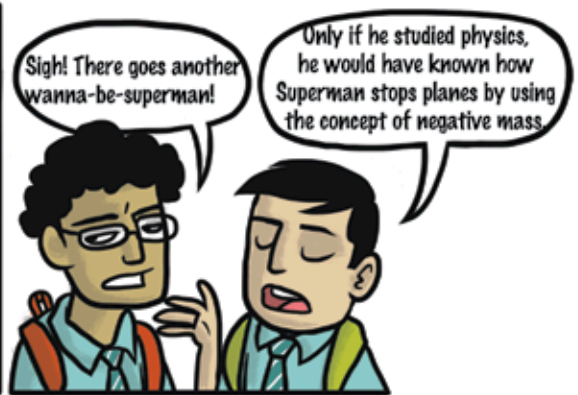


SUPERHEROES OF REALITY-LAND

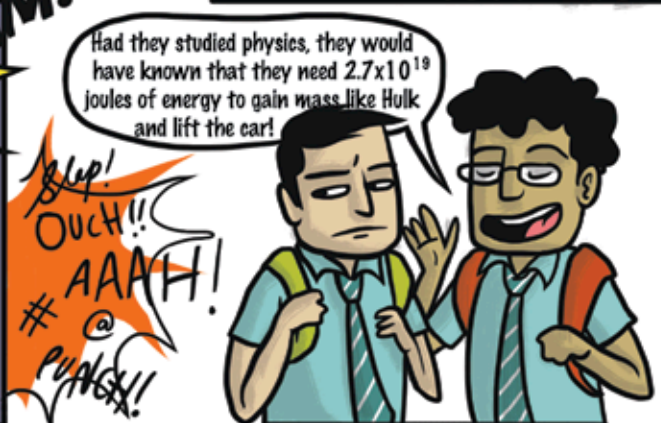
Story by Priyanka Talreja

Artwork by Jasjyot Singh Hans

If superheroes existed in a real-life scene, they would have made for some entertaining beings.



Falling, crashing and breaking their bones. All mothers would have to step out of their homes.





Tumbling from here, rolling from there, you would have never known what's falling out of the air.





Mirrors of the Earth

by Pushkar Samant

Image Source: Wikimedia commons

We look at ourselves in the mirror at least once a day. Mirrors show us how we look. But have you heard of the mirrors of the Earth? Yes, the Earth has mirrors and they are situated in the space. We call them artificial satellites. They reflect the looks of the Earth and perform many other useful activities.

Artificial satellites are manmade objects orbiting the

Earth. They are different from the natural satellites such as the Moon. Artificial satellites are used to study the Earth, to help us communicate and even to observe the Universe. We can call them 'smart mirrors'.

The films and cartoons we watch on TV, the maps we use on our smartphones, and the warnings we get about storms and heavy rains are all because of artificial satellites orbiting

the Earth. Some of these are used specifically to gather information about various stars, planets, comets and other heavenly bodies.

The first artificial satellite was the Soviet Sputnik-1, launched in 1957. Since then, dozens of countries have launched satellites. Since its first satellite, Aryabhata in 1975, India has launched 65 "smart mirrors" so far! ■

Hidden Heat

by Pushkar Samant

There are several invisible science powers around us, each working in its own unique way – some make things disappear, while some change the form or shape of matter.

One such power is latent heat. Ever seen ice turning into water? Ever wondered how water becomes vapor? The magic behind these is latent heat. Latent heat is the heat released or

absorbed by a body while changing its state.

In converting from ice to water, and then to vapor, energy is absorbed in the form of heat. Similarly, energy is released when the process is reversed. The temperature of water during the conversion is constant, which is why latent heat is often referred to as hidden heat! ■



Coin Well

by Kayomarz Bacha

All you need to perform this experiment is a coin, water and an ink dropper.

Place the coin flat on a table. Use the dropper and start dropping water on the coin, drop-by-drop. Keep count of the number of drops.

How many drops do you think will stay on

the coin, before the water overflows? 8 – 10 drops? Why don't you try it and let us know how many? You can even compete with friends and see who places more drops on the coin, before the water overflows.

By the way, the record at team Brainwave is 49 drops. ■

To watch the video, visit www.youtube.com/watch?v=6n9YrOdmOGO

What is surface tension? Research and email your answers to brainwave@ack-media.com
The most enthusiastic response can win you a cool gifts worth Rs. 200!

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more
bang for
your
buck!**

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content
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Friction Here, *Friction There*

by Bhoo

'Friction' sounds negative. But, when it comes to physics, it is what makes this world go round, literally! Let's see how.

Knock, knock: We need friction to open doors! Only when you hold onto the door knob, can you turn it around, right?

Walk the talk: Err, how would we walk without friction around? Slipping as soon as we step foot on the ground - life would be so funny!

My bags are packed and I'm ready to go: How would a plane fly without friction, I wonder. After all, it is the friction of air on the wings that creates the lift for the plane to stay airborne!

Brr, it is too cold: How very often do we rub our hands together in winter, to create body heat and keep ourselves warm? Without friction, that wouldn't have happened either!

Hey! Look out: When dad's driving the car, he uses the brakes so very often. Had it not been for friction, how would the rubber tyres come to a screeching halt?



Now that we know friction is what makes our life possible, let's imagine a life without it. How would we walk? Would we fly instead? Think of wacky ideas and send us an email, quick! Let's see how creative you can get. All replies to brainwave@ack-media.com, as always.



Be a Smartenstein!

We run more than ten activities and contests in each issue. They can win you many exciting prizes.

Participate in all the activities of an issue, and you can win a merit certificate, the title 'Smartenstein' and a mystery gift - every month!

There are more than 10 activities and contests in this issue. Turn to the index on [p02](#), check the features marked with a '★' out, and participate in them.

What are you waiting for? We have even introduced a contest by Pogo that gives you cool Pokemon goodies - on [p37](#)!

www.bwmag.in/category/bw-smartenstein



Artwork: Sarthak Sinha

Join us on our fun-do video channel as *Mr. X* performs some amazing experiments and *x-plains* the science behind them.

Mr. X will perform and publish your experiments too! Just email them to brainwave@ack-media.com



Artwork: Abhijeet Kini

You Tube www.youtube.com/Brainwavemag



Shake that Dries

We all know that dogs dry themselves up by doing the crazy dog shake, but what we didn't know is that there's loads of physics hidden behind that technique!

by Dr. Dodo

Wet dogs shake their bodies in such a precise and effective manner that washing machine designers are beginning to take inspirations from that!

Andrew Dickerson, a researcher at the Georgia Institute of Technology and his colleague David Hu used high-speed videography along with X-ray cinematography to see in detail what happens, both internally and externally, when a furry mammal shakes itself dry.

They observed that the shaking begins at the head area, which provides a solid point for the energy wave to propagate down the animal's body. Sometimes, the head twists more, resulting in higher amplitude waves.

Once a wave starts at the animal's head, its body and skin shake too. Even though the body shakes at the same frequency as that of the skin, it cannot rotate as far.

Very furry animals tend to have especially loose skin, which whips around as the animal shakes itself, increasing the acceleration. This can be compared to someone cracking a whip.

Dickerson's team discovered that animals with smaller bodies must shake more rapidly than larger animals. The tinier mammals can experience up to $20g^G$ acceleration. Larger mammals on the other hand, do not shake slower than about 4 hertz.

The highlight of this research is that, the frequency at which each animal shakes its body might even be unconsciously determined, based on nerve and muscle dynamics.

In addition to building better washing machines, these findings could lead to improvements in dryers, painting devices, spin coaters and other machines. ■



(((We hear you!)))

by Arby

What is sound?

Oh, that's something that's all around.

We use the word 'sound' ever so often,
But do we really know what makes it happen?

Simple as it is, I would like to say,
Sound's made when surfaces vibrate away!
Be it the school bell when it goes tring-tring.
Or us humans, when we try to sing!

In the case of the bell, the metal vibrates.
For us humans, it's the vocal chord that shakes.

We hear when these vibrations enter our ear,
Reflecting against our eardrum makes it
audible and clear.

The faster the vibration, the higher the sound,
Human ears can't detect anything less than 20
vibrations per second.

And if that sound's higher than 20,000
vibrations per second,
Un-huh, no human will notice, it never
happened! ■

This was the story of our ear and sound. Take a break and tell us - is there something you can't hear now? Name any 5 sounds outside the 20-20,000 vibrations per second range that occur around us all the time, but we can't hear.

To get a chance to win some cool comics, email your answers to:
brainwave@ack-media.com





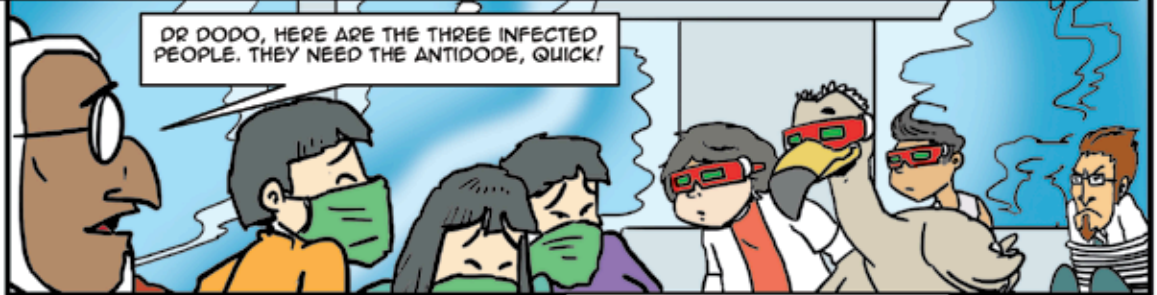
THE SMARTIES

FLOAT YOUR OWN BOAT

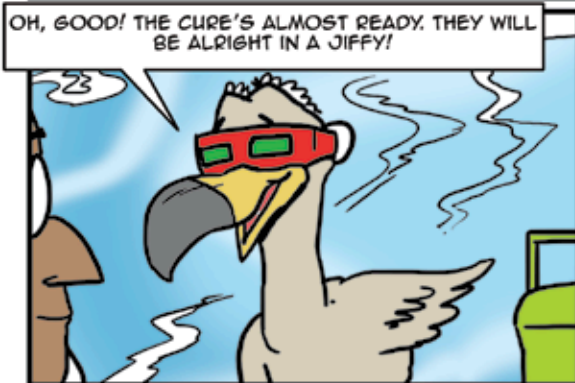
STORY: PRIYANKA TALREJA

ART & LETTERING: ABHIJEET KINI

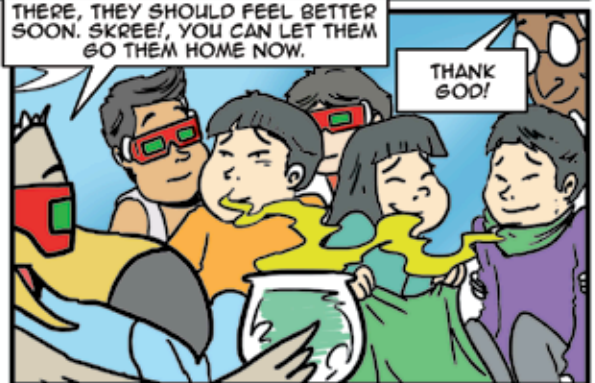
PREVIOUSLY... SKREE! BROUGHT THE PEOPLE X HAD INFECTED WITH A DEADLY VIRUS BACK TO THE LAB AND BHOO WENT LOOKING FOR THE OTHERS WHO COULD HAVE BEEN INFECTED TOO.



DR DODO, HERE ARE THE THREE INFECTED PEOPLE. THEY NEED THE ANTIDOTE, QUICK!



OH, GOOD! THE CURE'S ALMOST READY. THEY WILL BE ALRIGHT IN A JIFFY!



THERE, THEY SHOULD FEEL BETTER SOON. SKREE!, YOU CAN LET THEM GO THEM HOME NOW.

THANK GOD!



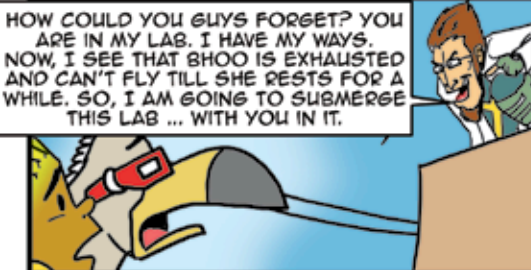
DR DODO, I HAVE AWFUL NEWS. THE DISEASE IS HIGHLY CONTAGIOUS; IT HAS SPREAD TO MANY ALREADY!



NOW, X, WE'LL DEAL WITH YOU.

HE'S ESCAPED AGAIN!

NOTHING TO PANIC ABOUT, BHOO. I HAVE FIGURED OUT THE CURE. ALBY, ARBY - FILL UP THE PLANE'S DISPENSER WITH IT AND SPRAY IT ALL OVER THE CITY?

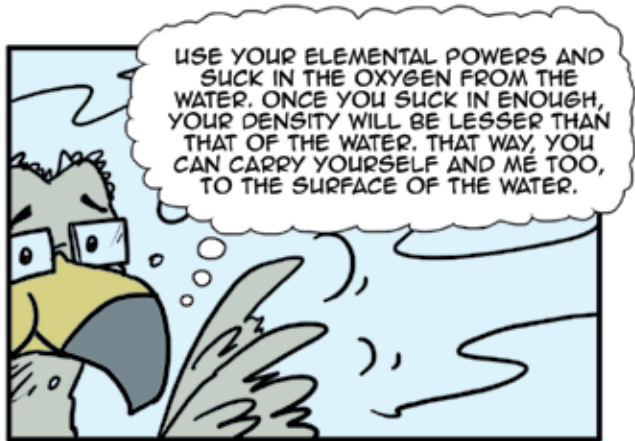
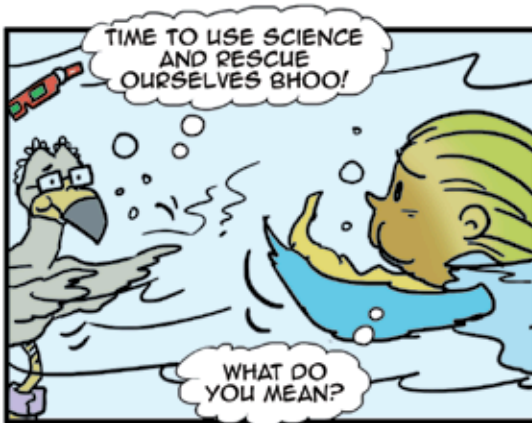


HOW COULD YOU GUYS FORGET? YOU ARE IN MY LAB. I HAVE MY WAYS. NOW, I SEE THAT BHOO IS EXHAUSTED AND CAN'T FLY TILL SHE RESTS FOR A WHILE. SO, I AM GOING TO SUBMERGE THIS LAB ... WITH YOU IN IT.



CLICK!

WHOOOSSHH!





Laws of Flotation

by Kayomarz Bacha

You need:

- A transparent glass
- A pair of scissors
- Tissue paper
- Steel paper clip
- A pencil
- Water



METHOD:



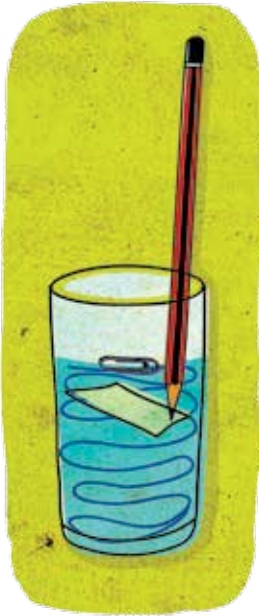
2 Cut out a small square piece of tissue paper.



3 Place the square piece of tissue paper on the surface of the water.



4 Carefully and gently, place the paper clip on the tissue.



5

Use the pencil to carefully push down on the tissue paper, away from the clip. ■

WHY DOES THIS HAPPEN?

Normally, a paperclip sinks when placed on water since it has a higher density than that of water.

But in this case, a physics phenomenon called surface tension prevents the clip from sinking. Due to surface tension, when you perform the experiment smoothly, water molecules on the surface of the water hold on to each other, forming a layer that prevents the clip from sinking.

SCIENCE FACT:

Insects and some birds are able to float and sometimes, walk on water due to surface tension.

What is the science behind surface tension? Research and email your answers to brainwave@ack-media.com. The best answer wins 2 cool ACK comic books!



MON - THU 9:30 PM



BRAINWAVE

Time to grab exclusive goodies from Pogo! To win all you have to do is answer this simple rebus. Can you guess the sentence hidden behind these visuals?

Example



Belief



makes



the



world



go



round

Can you figure out the science fact hidden behind these images?



Ans : _____

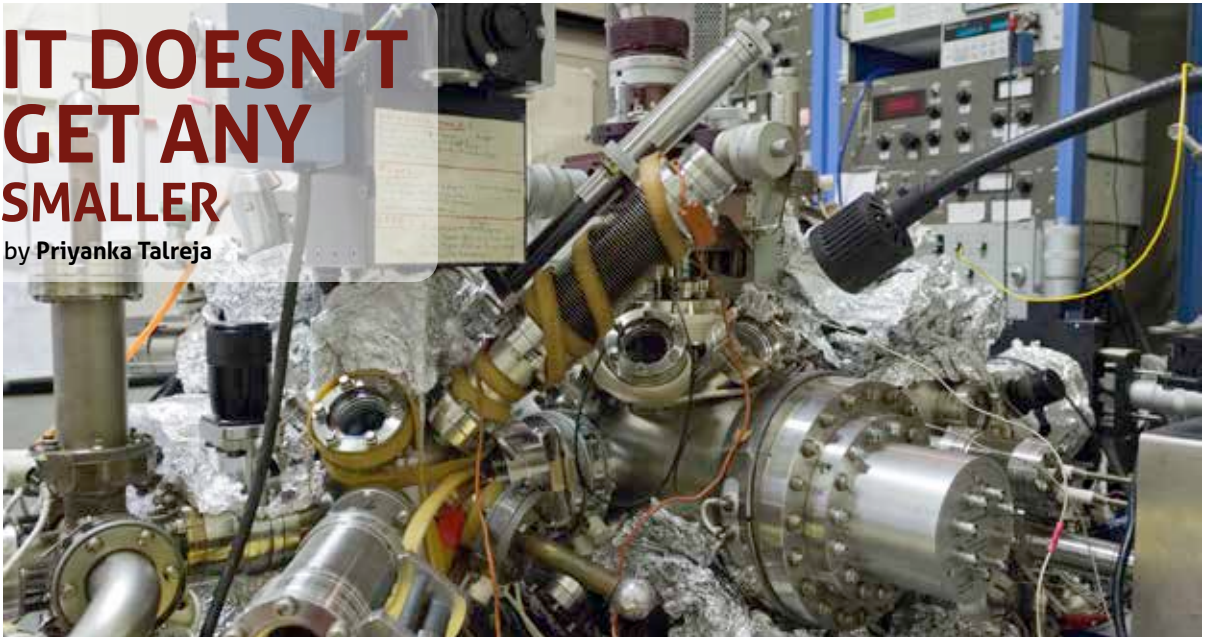
Send your entries to brainwave@ack-media.com





IT DOESN'T GET ANY SMALLER

by Priyanka Talreja



We all know that atoms are the basic units of matter. We also know that the human eye cannot see an atom without the help of a microscope. But now, thanks to science, it is possible to not have a microscope and still see an atom!

IBM has now made the 'smallest' film ever titled *A Boy and His Atom*.

This film is not the smallest because it ends before it starts. This film is the smallest because it is made with atoms! Confused? Read on.

While the nanophysicists at IBM were researching on ways to move individual atoms in order to invent methods to store more computer data in lesser space, they created a two ton microscope that magnifies objects 100 million times. This microscope is known as the scanning tunneling

microscope (STM) and it operates at just above absolute zero (-268 Celsius).

Though the body of this microscope is that of two tons, the actual microscope is essentially a very small metal needle that is moved over a sample. By increasing the voltage, the needle can also pick up individual atoms and move them to a new location.

A Boy and His Atom is thus made by moving single carbon atoms around a copper surface. This film is made of 242 individual **stop-motion**^G frames, each frame being roughly 50 atoms wide.

Now here's the interesting part - a single human hair is about 1,000,000 atoms wide. So, if IBM wished, they could convert *A Boy and His Atom* into a feature film, and still it would fit within the width of a single human hair.

How crazily tiny is that! And rightfully so, the Guinness World Records has announced that *A Boy and His Atom* is the smallest film ever made.

Check out this film on YouTube and let us know what you think! As you watch it, just remember - you are looking at single carbon atoms moving around. ■



GRAPHIC
NOVEL

T TIME GLIDERS

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Join our team of time travellers from 2550 A.D.
whose mission it is to discover and learn more about
our Universe!

August 2013 39

Meet the team



By 2550 A.D., time travel has been perfected. This led to the Time Glider project, run by a consortium of science and engineering departments from all over the world. The aim is to gain a better understanding of certain difficult, science-related issues. There are various Time Glider teams, but the first mission belongs to TG-1, the spacecraft commandeered by professor Patel.

Time Gliders Command has one directive: TG teams are assigned to discover and explore, but are under no circumstances allowed to interfere with human history. This may cause uncontrollable ripple effects that may jeopardize the very future existence of the Time Gliders agency!

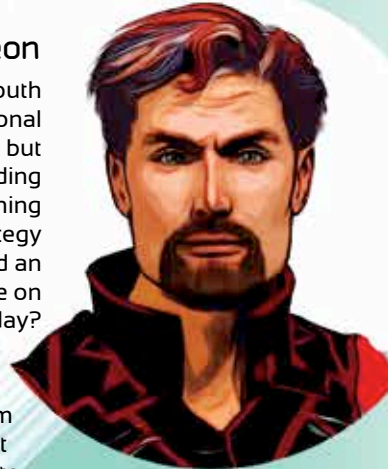
Professor Patel

Commander of TG-1, and co-founder of the International Time Gliders Agency, he is commonly known as "Prof". Born in Kolkata, India, he boasts several Nobel prizes in the natural sciences. His specialty is quantum physics and string theory—frequently causing him sleepless nights. It is no secret that Prof loves hot curry, which, according to him, helps him "to think better".



Deon

Pilot, and in charge of security. Born in Pretoria, South Africa, Deon is a new recruit from the International Space Flight Academy, and ready for adventure—but tends to be somewhat impulsive at times, finding himself in dangerous situations. Deon loves anything that is fast. As a kid he was a champion in strategy games on the PlayStation 999, and developed an interest in human history. Who knows, his knowledge on this subject might even come in handy someday?



Liz

Engineer and data analyst. Born and raised on a farm in Australia, she loved helping her dad fix equipment rather than playing with dolls. She sometimes got into trouble at school after altering machines to "improve" them—without permission! Liz developed a special interest in nanotechnology and endeavors to one day receive the Nobel Prize in this field.



Quasar

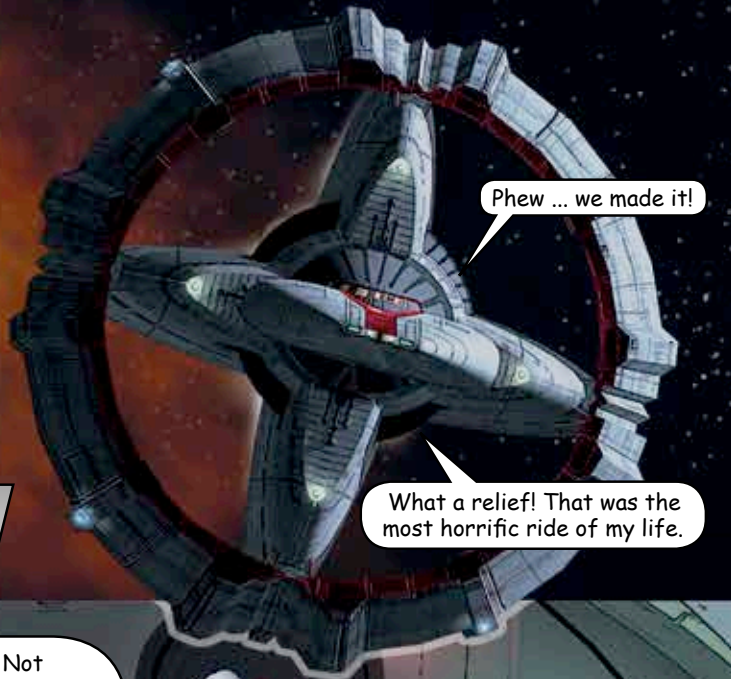
Logistics and timeline navigator. Quasar is, well, basically from all over the world. He was conceived in a Japanese robotics laboratory, but developed further in India. Most of his parts are from China, but he was finally assembled in Germany. Having a limited capacity to experience human-like emotions, it is no wonder he is wrestling somewhat to find his own identity. Quasar has a special taste for Castrol lubricants as it helps keep his joints in tip-top shape.



TIME GLIDERS

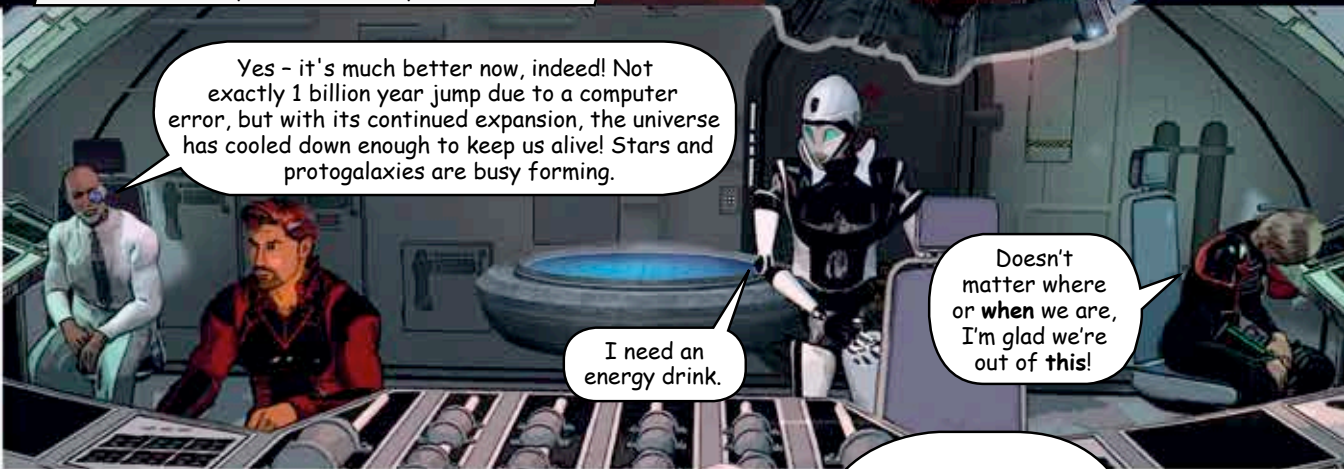
Episode 2 "In the Beginning"

Previously... The Time Glider team narrowly escaped a devastating energy bombardment inside the infant Universe by managing to jump ahead in time by about 1 billion years.



Phew ... we made it!

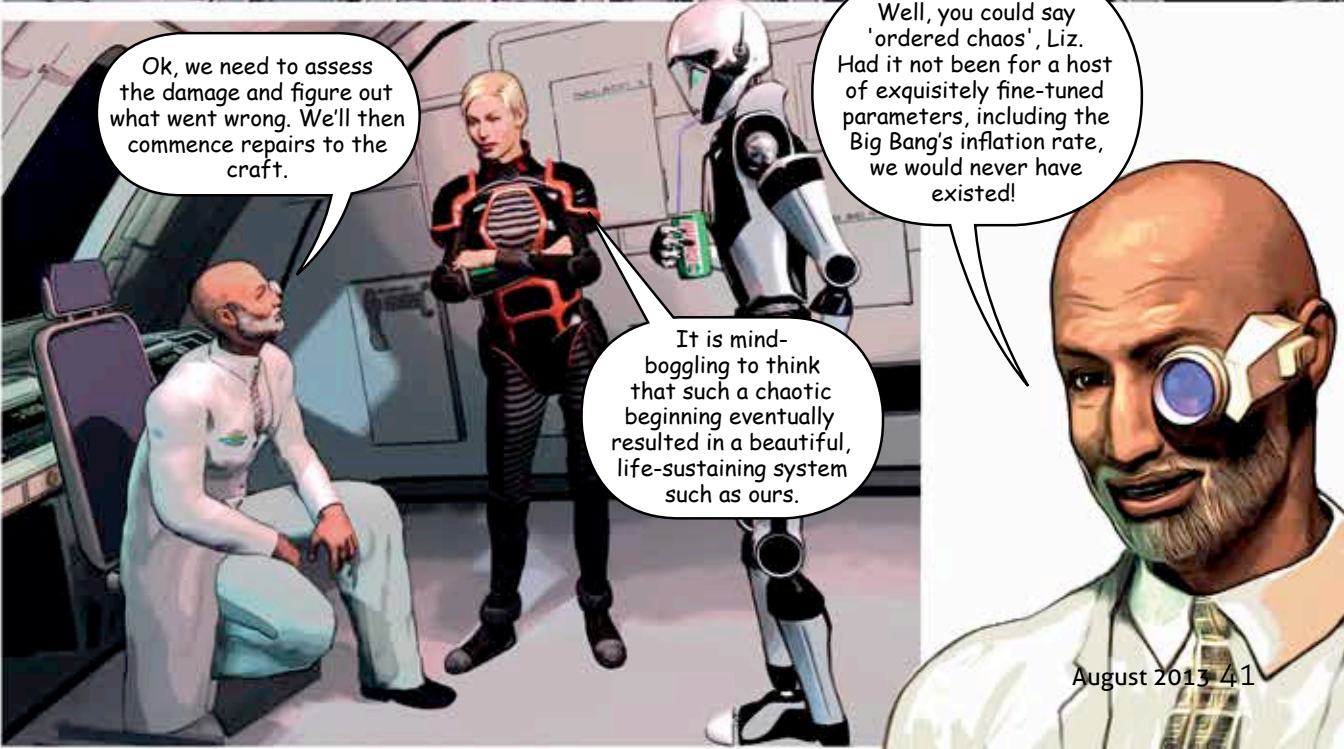
What a relief! That was the most horrific ride of my life.



Yes - it's much better now, indeed! Not exactly 1 billion year jump due to a computer error, but with its continued expansion, the universe has cooled down enough to keep us alive! Stars and protogalaxies are busy forming.

I need an energy drink.

Doesn't matter where or when we are, I'm glad we're out of this!

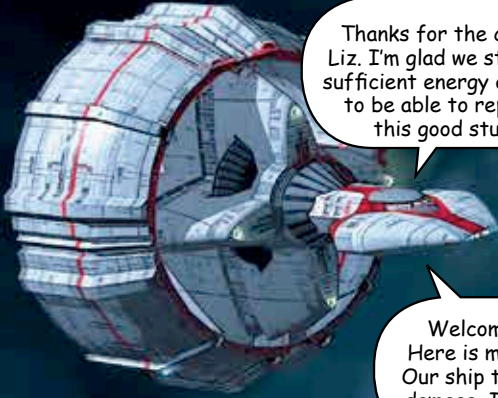


Ok, we need to assess the damage and figure out what went wrong. We'll then commence repairs to the craft.

It is mind-boggling to think that such a chaotic beginning eventually resulted in a beautiful, life-sustaining system such as ours.

Well, you could say 'ordered chaos', Liz. Had it not been for a host of exquisitely fine-tuned parameters, including the Big Bang's inflation rate, we would never have existed!

Later, in the ship's living quarters ...

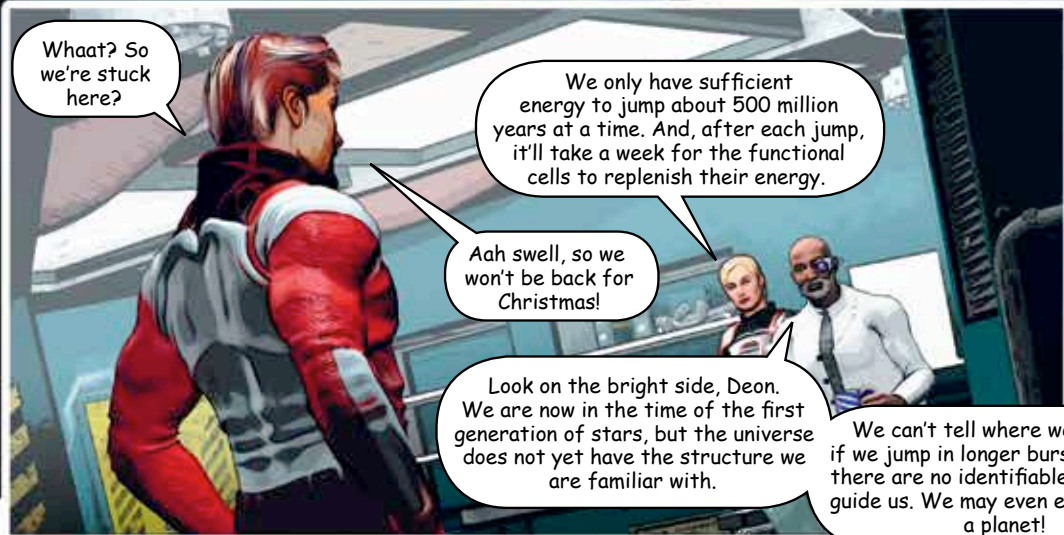


Thanks for the coffee, Liz. I'm glad we still have sufficient energy on board to be able to replicate this good stuff.

Welcome Prof. Here is my report. Our ship took heavy damage, I'm afraid.

Hmm ... not good! How long do you estimate repairs will take?

That's what I wanted to discuss with you. There's permanent damage to some of the fusion reactor cells that can only be repaired back at the agency.



Whaat? So we're stuck here?

We only have sufficient energy to jump about 500 million years at a time. And, after each jump, it'll take a week for the functional cells to replenish their energy.

Aah swell, so we won't be back for Christmas!

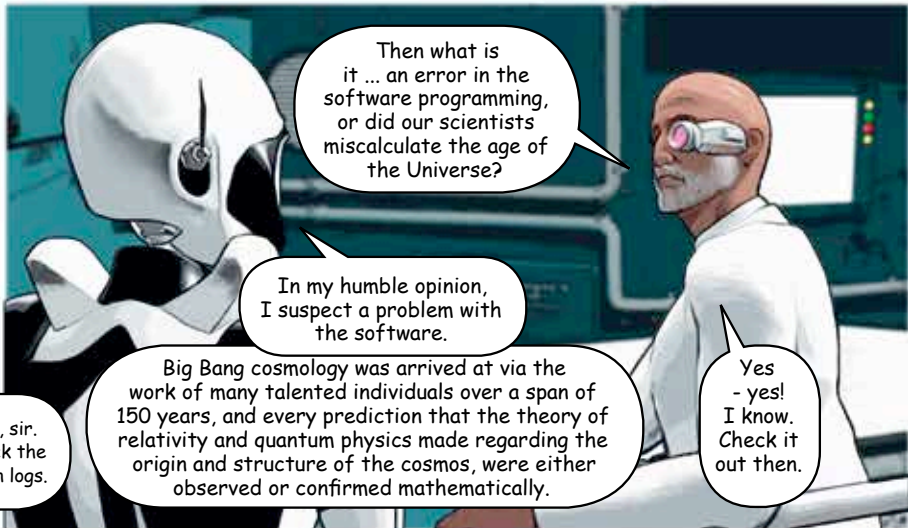
Look on the bright side, Deon. We are now in the time of the first generation of stars, but the universe does not yet have the structure we are familiar with.

We can't tell where we'll end up if we jump in longer bursts, because there are no identifiable beacons to guide us. We may even end up inside a planet!



Quasar! How on Earth could this timing error have occurred? You must have misread the ship's instruments!

N-Negative, sir. You can check the ships' mission logs.



Then what is it ... an error in the software programming, or did our scientists miscalculate the age of the Universe?

In my humble opinion, I suspect a problem with the software.

Big Bang cosmology was arrived at via the work of many talented individuals over a span of 150 years, and every prediction that the theory of relativity and quantum physics made regarding the origin and structure of the cosmos, were either observed or confirmed mathematically.

Yes - yes! I know. Check it out then.

One day later ...

Professor - I have traced the origin of our problem! It was a computer virus that caused the calculation error, but I have now neutralized it.

What? How could this have happened?

A virus? Is that for real?! Surely none of you could be behind this - unless somebody had a death wish?

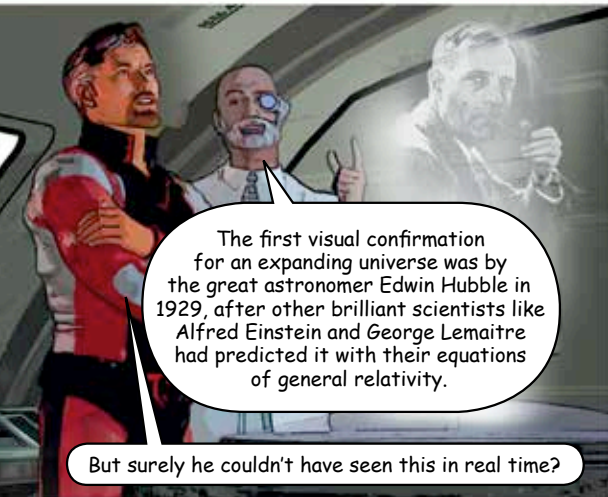
We'll get to the bottom of this once we go back.

OK, let's jump as soon as repairs are done.

Over several weeks, the Time Gliders jump forward in time to get back to their time.

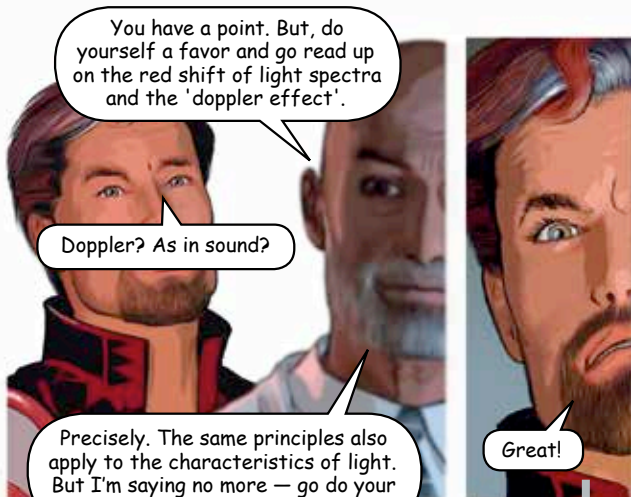
Has any of you noticed that, each time we go forward in time, the galaxies move further apart from each other?

Yes ... that's true!



The first visual confirmation for an expanding universe was by the great astronomer Edwin Hubble in 1929, after other brilliant scientists like Alfred Einstein and George Lemaitre had predicted it with their equations of general relativity.

But surely he couldn't have seen this in real time?



You have a point. But, do yourself a favor and go read up on the red shift of light spectra and the 'doppler effect'.

Doppler? As in sound?

Precisely. The same principles also apply to the characteristics of light. But I'm saying no more — go do your homework!

Great!

One time jump later and at long last!

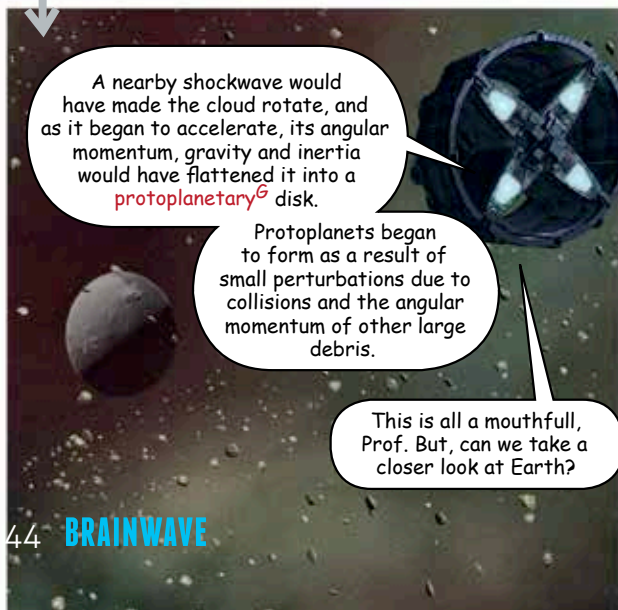


Tha-a-a-at's better! What you see, ladies and gentlemen, is our primordial solar system.

We are now in the Hadean era of Earth's history - about 4527 million years in the past.

What are those discs surrounding the Sun?

Ah! That confirms the solar nebula hypothesis! That is residue from the original solar nebula, a giant cloud which consisted of hydrogen, helium and heavier elements ejected by the supernovae of other stars.



A nearby shockwave would have made the cloud rotate, and as it began to accelerate, its angular momentum, gravity and inertia would have flattened it into a protoplanetary disk.

Protoplanets began to form as a result of small perturbations due to collisions and the angular momentum of other large debris.

This is all a mouthfull, Prof. But, can we take a closer look at Earth?



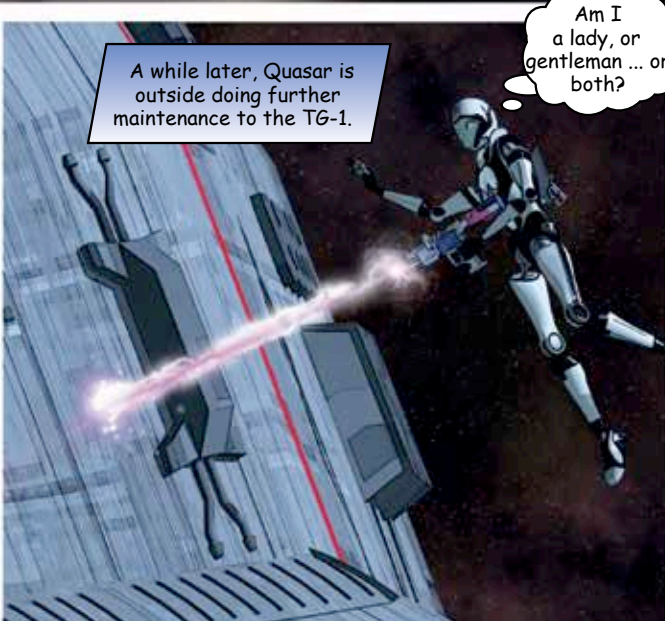
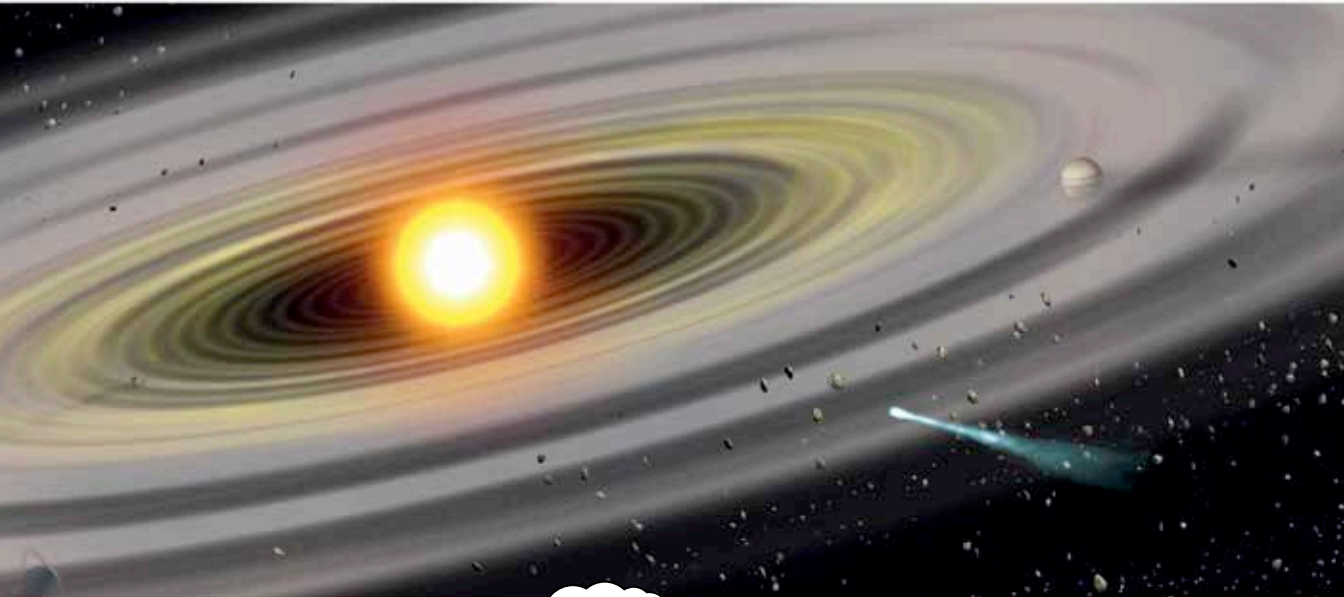
No way, Deon! It is currently a very violent place, being bombarded constantly with heavy meteor showers. Its crust is molten, and its atmosphere, consists of dense gasses, steam and interplanetary debris.



Liz, Quasar and you carry on with the maintenance of our ship, to prepare for the next jump while I go to my quarters. Deon, you keep a close watch on our surroundings.

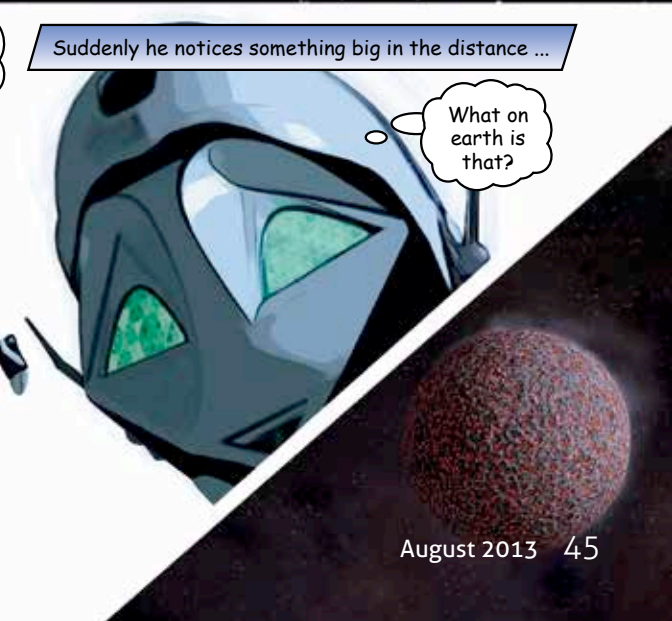
No problem, Prof!

Space around us is hostile with all sorts of projectiles risking to hit us.



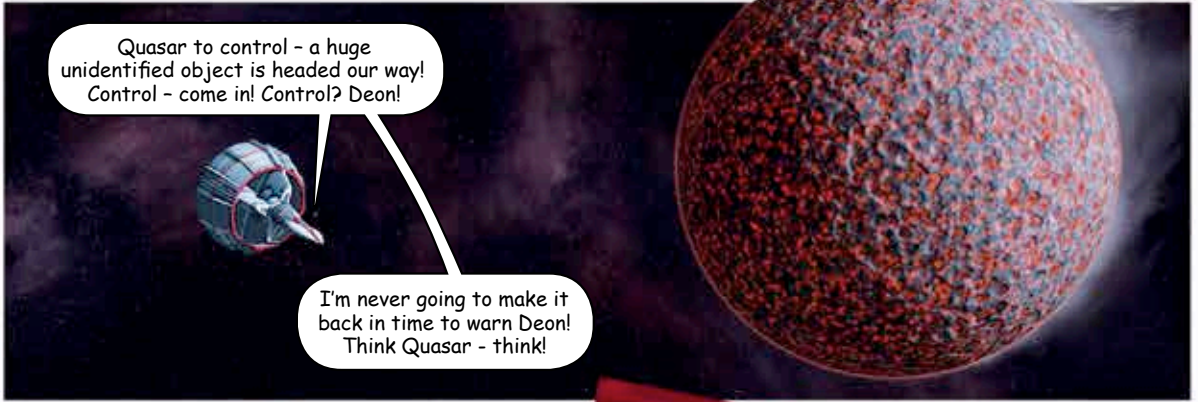
A while later, Quasar is outside doing further maintenance to the TG-1.

Am I a lady, or gentleman ... or both?



Suddenly he notices something big in the distance ...

What on earth is that?





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Treasure Hunt!

The Treasure Hunt is here. Take your magnifying glass out and become the adventurer. This month, we have a list of clues strewn across the magazine. Each clue is represented by a  symbol.

The treasure you have to unearth is the theme of the next issue. Read the magazine carefully, spot the clues and get cracking.

.....

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p05

Lift: Lift is a mechanical force that directly opposes the weight of an aeroplane and holds the plane in the air. Lift is generated when an object moves through a fluid such as air. This happens due to Newton's third law of motion. To understand the concept of lift in greater details, visit NASA's website at www.grc.nasa.gov/WWW/k-12/airplane/lift1.html

p15

Thermodynamics: Thermodynamics is the study the relationship between heat and other properties such as pressure, density, temperature, energy and work, in a substance. The focus is on how various energy changes happen within a physical system.

p22

Gilbert: William Gilbert was an English physician and physicist who lived in the 16th century. He is remembered largely for his book *De Magnete*, and is credited as one of the originators of the term 'electricity'. He is regarded by some as the father of electrical engineering or electricity and magnetism.

Huygens: Christiaan Huygens, was a prominent Dutch mathematician, astronomer and physicist who lived in the 17th century. His work included early telescopic studies of the rings of Saturn and the discovery of its moon Titan, the invention of the pendulum clock and most importantly, the wave theory of light.

p30

g: g stands for the acceleration imparted by gravity at the earth's surface. $1\text{ g} = 9.8\text{ m/s}^2$. Accelerations that are greater than 1g are usually expressed in multiples of g, such as 2g, 3g, etc.

p36

Stop Motion: Stop motion is an animation technique to make a physically manipulated object appear to move on its own. You can

check out a sample at www.youtube.com/watch?v=GljoSxj1zul

p42

Solar Nebula: Our solar system began forming within a cloud of interstellar dust and hydrogen gas. The cloud contracted under its own gravity and our Sun formed in the hot dense center. The remainder of the cloud formed a swirling disk called the solar nebula, out of which planets, moons, etc. formed.

Spot The Errors

Finished reading the magazine?

We have an innovative contest instead of a quiz this time. Win it and a **mystery gift worth Rs. 500** is yours!

What you need to do:

There are a few mistakes in this magazine. They are either science or English grammar related. Identify as many of these as you can and email us at brainwave@ackmedia.com

Please ensure that you mention the page and paragraph numbers of each mistake.

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